GATES LEARJET CORPORATION

maintenance manual

# CHAPTER

# 80

# STARTING

| Chapter Section Subject | Page | Date |
|---|---|---|
| 80-Title | | |
| *80-List of Effective Pages | 1 | May 25/84 |
| 80-Contents | 1 | Dec 2/77 |
| 80-00-00 | 1 | Dec 2/77 |
| 80-00-00 | 2 | Dec 2/77 |
| 80-10-00 | 1 | Dec 2/77 |
| 80-10-00 | 2 | Dec 2/77 |
| 80-10-00 | 3 | Dec 2/77 |
| 80-10-01 | 201 | Dec 2/77 |
| 80-10-01 | 202 | Dec 2/77 |
| *80-10-01 | 203 | May 25/84 |
| 80-11-00 | 1 | Dec 2/77 |
| 80-11-00 | 201 | Dec 2/77 |
| 80-11-00 | 202 | Dec 2/77 |

| Chapter Section Subject | Page | Date |
|---|---|---|

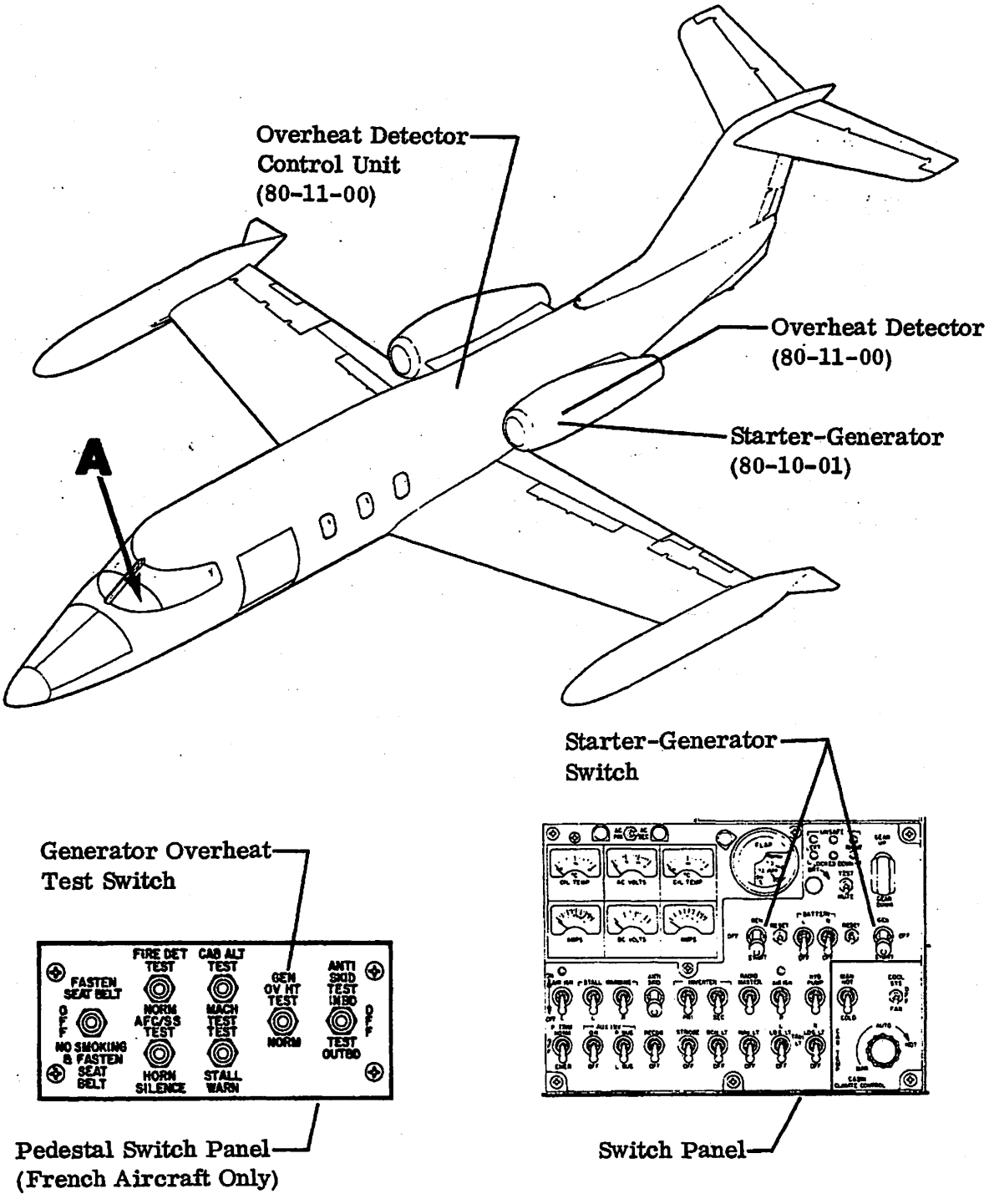
Insert Latest Revised Pages; Destroy Superseded or Deleted Pages.
*Asterisk indicates pages revised, added or deleted by current revision.
The portion of the text affected by the current revision is indicated by a vertical line in the outer margin of the page.

| Subject | Chapter Section Subject | Page |
|---|---|---|
| GENERAL | 80-00-00 | |
| General | 80-00-00 | 1 |
| Description | 80-00-00 | 1 |
| CRANKING | 80-10-00 | |
| General | 80-10-00 | 1 |
| Operation | 80-10-00 | 1 |
| Starter - Maintenance Practices | 80-10-01 | |
| General | 80-10-01 | 201 |
| Removal/Installation | 80-10-01 | 201 |
| Adjustment/Test | 80-10-01 | 203 |
| Inspection/Check | 80-10-01 | 203 |
| Overheat Detector | 80-11-00 | |
| General | 80-11-00 | 1 |
| Description | 80-11-00 | 1 |
| Operation | 80-11-00 | 1 |
| Overheat Detector System - Maintenance Practices | 80-11-00 | |
| General | 80-11-00 | 201 |
| Removal/Installation | 80-11-00 | 201 |

## GENERAL - DESCRIPTION AND OPERATION

1. General
   A. The engine starting system consists of two starter-generators, two system switches and utilizes the generator control box which incorporates the start control relays.
   B. On Aircraft certified for Operation in France, the engine starting system consists of two starter-generators, two system switches, the generator control box which incorporates the start control relays, and overheat detector system on each starter-generator.

2. Description
   A. The starter-generator is installed on engine accessory gear box by six bolts. All electrical connections are made to a terminal block on the starter-generator. The starter-generator operates from power supplied by either an external power source or the battery system. Refer to 24-00-00 for further information on the external power source and the battery system.
   B. The system switches are three position lever lock type switches located on the switch panel. The switches are labeled GEN-OFF-START.
   C. The generator control box incorporates the starting relay functions. For Maintenance Practices of the generator control box refer to 24-31-02.
   D. On Aircraft certified for Operation in France, the overheat detector system provides the crew with a visual indication of each starter-generator. The system is tested by the GEN OV HT TEST-NORM Switch.




## Detail A

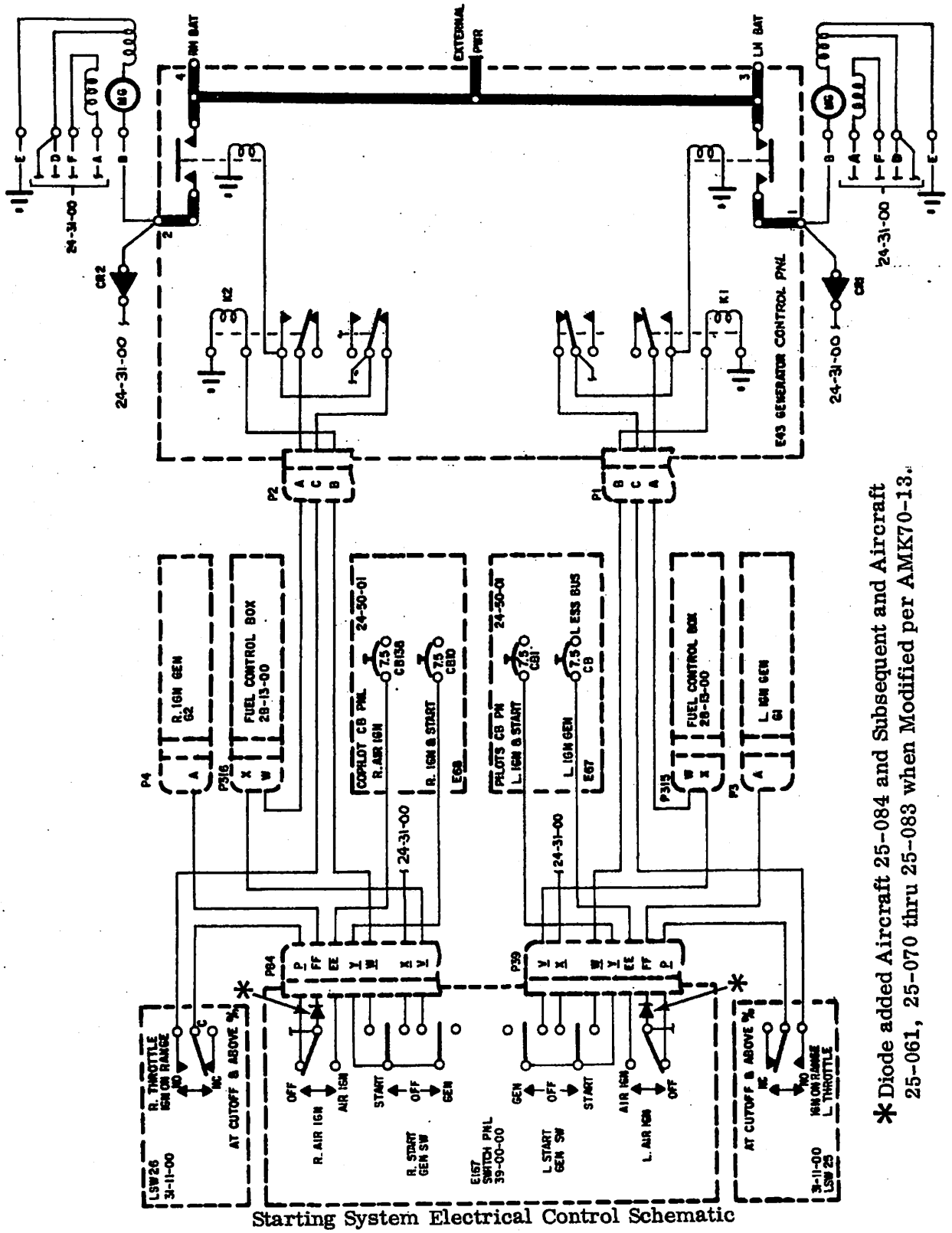
Starting System Component Location
Figure 1

## CRANKING - DESCRIPTION AND OPERATION

1. General
   A. Starting (cranking) is accomplished by applying power to the aircraft and setting the Starter-Generator Switch to START.

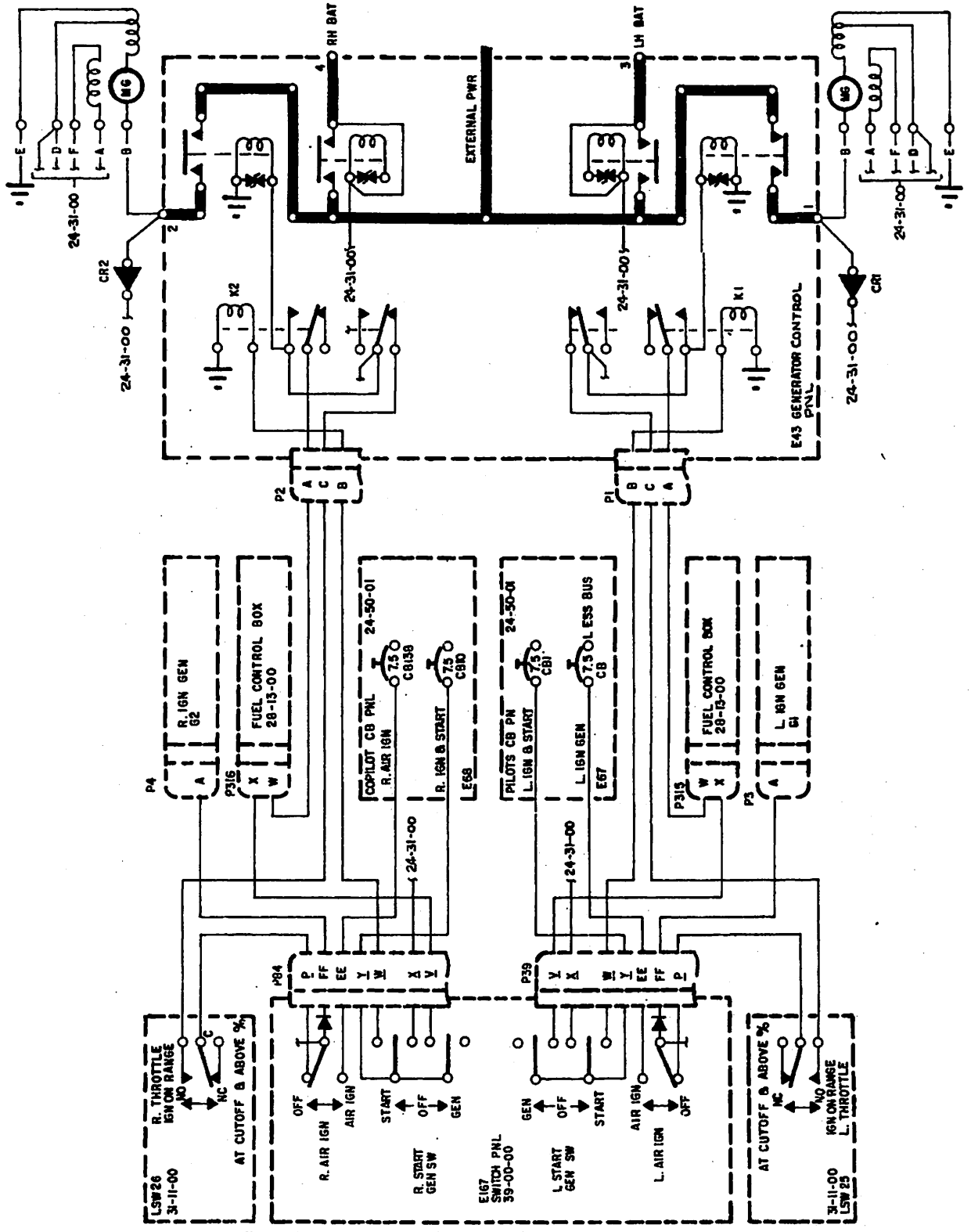
      CAUTION: IF ENGINE START IS NOT ACCOMPLISHED AFTER THE THIRD ATTEMPT, THE STARTER-GENERATOR MUST BE ALLOWED TO COOL TO AMBIENT TEMPERATURE. LIMIT EACH STARTING ATTEMPT TO A MAXIMUM OF 30 SECONDS.

2. Operation (See figure 1)
   A. First Engine Start
      (1) When the Starter-Generator Switch is set to START, 28 vdc is applied to the start control relay within the fuel control relay panel and to a control relay (K1 or K2) within the generator control box. With the start control relay energized, 28 vdc is applied thru a set of contacts to close the motive flow valve and at the same time 28 vdc is applied to energize the standby boost pumps. When the motive flow valve closes 28 vdc is applied thru the motive flow valve, thru the start control relay, thru a set of contacts on the energized relay (K1 or K2) to energize the applicable starter relay. When the engine speed exceeds idle rpm the Starter-Generator Switch is then set to GEN.
   B. Second Engine Start
      (1) Starting the second engine is the same as the first engine start except that the output of the first generator is utilized in assisting the second engine start.




Starting System Electrical Control Schematic
Figure 1 (Sheet 1 of 2)

* Diode added Aircraft 25-084 and Subsequent and Aircraft 25-061, 25-070 thru 25-083 when Modified per AMK70-13.




Starting System Electrical Control Schematic
Figure 1 (Sheet 2 of 2)

## STARTER - MAINTENANCE PRACTICES

1. General
   A. Maintenance practices on the starter-generators consist basically of trouble shooting, starter-generator brush wear check and replacement of defective components.

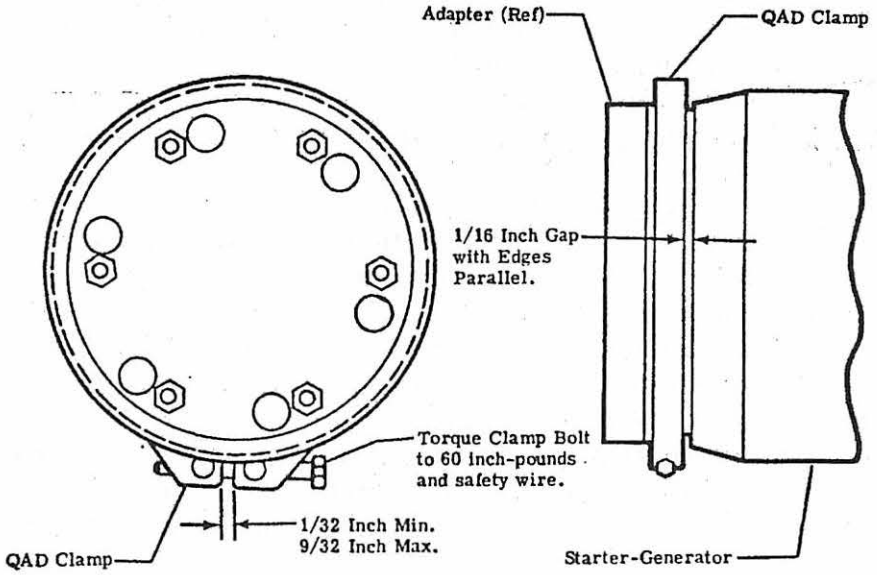
2. Removal/Installation
   A. Remove Starter-Generator (See figure 201)
      (1) Lower tailcone access door and disconnect aircraft batteries.
      (2) Remove lower engine nacelle.
      (3) Disconnect and tag starter-generator electrical wiring.
      (4) Loosen clamps and remove air duct from forward nacelle and starter-generator.
      (5) Remove safety wire from Q.A.D. clamp bolt.
      (6) Loosen Q.A.D. clamp bolt sufficiently to allow removal of generator.
      (7) Remove starter-generator from aircraft.
      (8) If replacement starter-generator is to be installed, loosen and remove attaching parts and existing Q.A.D. adapter assembly and use new adapter assembly furnished with generator.
   B. Install Starter-Generator (See figure 201)
      (1) Before installing new Q.A.D. adpater assembly on engine, check that the three (3) screws attaching adapter plate to the adapter ring do not protrude above the mounting surface. Inspect Q.A.D. clamp for possible damage.
      (2) Check that Q.A.D. assembly slides freely over the gearbox studs and fits against gearbox.
      (3) Assure that gearbox housing, starter-generator housing, adapter plate mounting surface, Q.A.D. clamp and spline are clean and free of foreign matter.
      (4) Install adapter assembly on gearbox housing and secure with attaching parts. Torque nuts 160 to 190 inch-pounds plus drag torque.

      CAUTION: ASSURE THAT BOTH SPLINES ARE CLEAN BEFORE APPLYING NEW GREASE. THIS WILL PREVENT CONTAMINATION OF NEW GREASE.

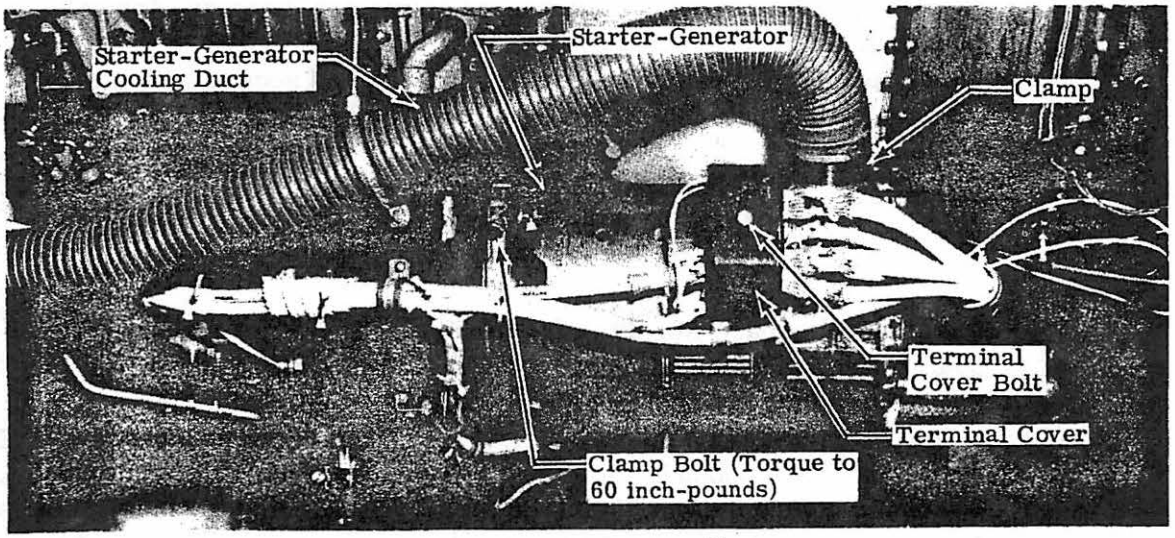
      (5) Apply Mobil grease No. 29 (mfg. by Mobil Oil Corp.) or Braycote No. 664S (mfg. by Bray Oil Co.) to male spline of starter-generator. Apply grease to screw threads and V-groove of Q.A.D. clamp.
      (6) Install starter-generator and Q.A.D. clamp on engine. Torque Q.A.D. clamp to 60 inch-pounds while moving end of generator back and forth. This will assure that no binding occurs. After torquing clamp to 60 inch-pounds check space between ends of clamp. Distance should be between 1/32 inch minimum to 9/32 inch maximum. Safety wire bolt.

(7) Remove tags and connect electrical wiring to generator. Install and secure terminal cover.

NOTE: Effective Aircraft 25-219 and Subsequent, the generator wiring has identification tags installed on each wire approximately 2 inches from the terminal. These tags will aid when wiring is connected to the starter-generator.




Q.A.D. Clamp Installation




Starter-Generator Installation
Figure 201

(8) Install starter-generator cooling duct and secure with clamp.
(9) Install and secure lower engine nacelle.
(10) Connect aircraft batteries and secure tailcone access door.
(11) Perform operational check of starter-generator.

3. Adjustment/Test

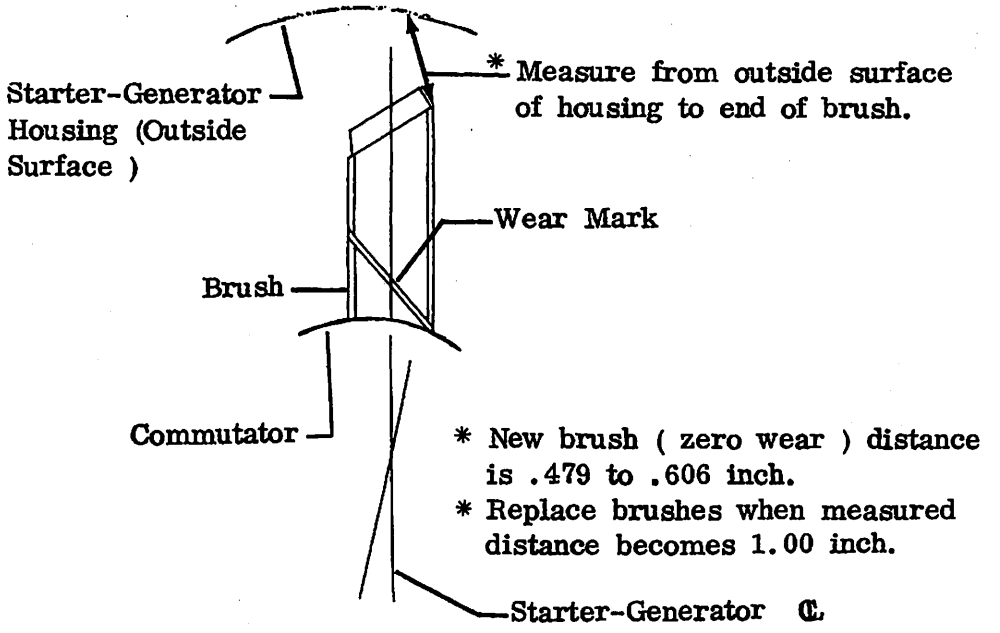
A. Operational Test of Starter

(1) Connect external power source to aircraft.
(2) Set Battery Switch(es) to "on".
(3) Set applicable starter-generator switch to START.
(4) Monitor engine rpm; at 8% to 10% rpm set Starter-Generator Switch to OFF.
(5) Set Battery Switch to OFF.
(6) Disconnect external power source.

4. Inspection/Check

A. Starter-Generator Brush Wear Check (See figure 202.)

(1) Remove lower engine nacelle.
(2) Remove starter-generator from engine.
(3) Remove brush cover from starter-generator.
(4) Refer to figure 202 and check brush wear.
(5) Install brush cover on starter-generator.
(6) Install starter-generator on engine.
(7) Install lower engine nacelle.




Starter-Generator Brush Wear Check
Figure 202

# OVERHEAT DETECTOR SYSTEM - DESCRIPTION AND OPERATION

1. General
   A. The overheat detector system consists of a detector element on each starter-generator, two warning (red) lights, two control units and a system test switch.

2. Description
   A. A detector element is installed on the aft portion of each starter-generator such that it senses the temperature of the cooling air as it exhausts from the starter-generator. The element is secured to the element bracket by quick release fasteners.
   B. Two warning (red) lights are installed in the glareshield warning light assembly. The lights are labeled L GEN OV HT and R GEN OV HT. The lights will illuminate when an overheat condition exists.
   C. The system test switch, labeled GEN OV HT TEST-NORM, is located on the pedestal switch panel. The switch is used to operationally test the system and is normally in the NORM position.
   D. The control units, one for RH and one for LH are installed on the RH electrical equipment tray in the tailcone.

3. Operation
   A. The starter-generator cooling is provided by air routed thru a flexible ducting from the nacelle nose cap air intake to the starter-generator. The detector element, installed over the exhaust openings at the rear of the starter-generator, senses the temperature of the air as it exhausts from the starter-generator. If the air temperature increases, due to overheating of the generator, the control units are energized and light the warning lights on the glareshield.

## OVERHEAT DETECTOR SYSTEM - MAINTENANCE PRACTICES

1. General
   A. Maintenance practices consist basically of removal and installation of components.

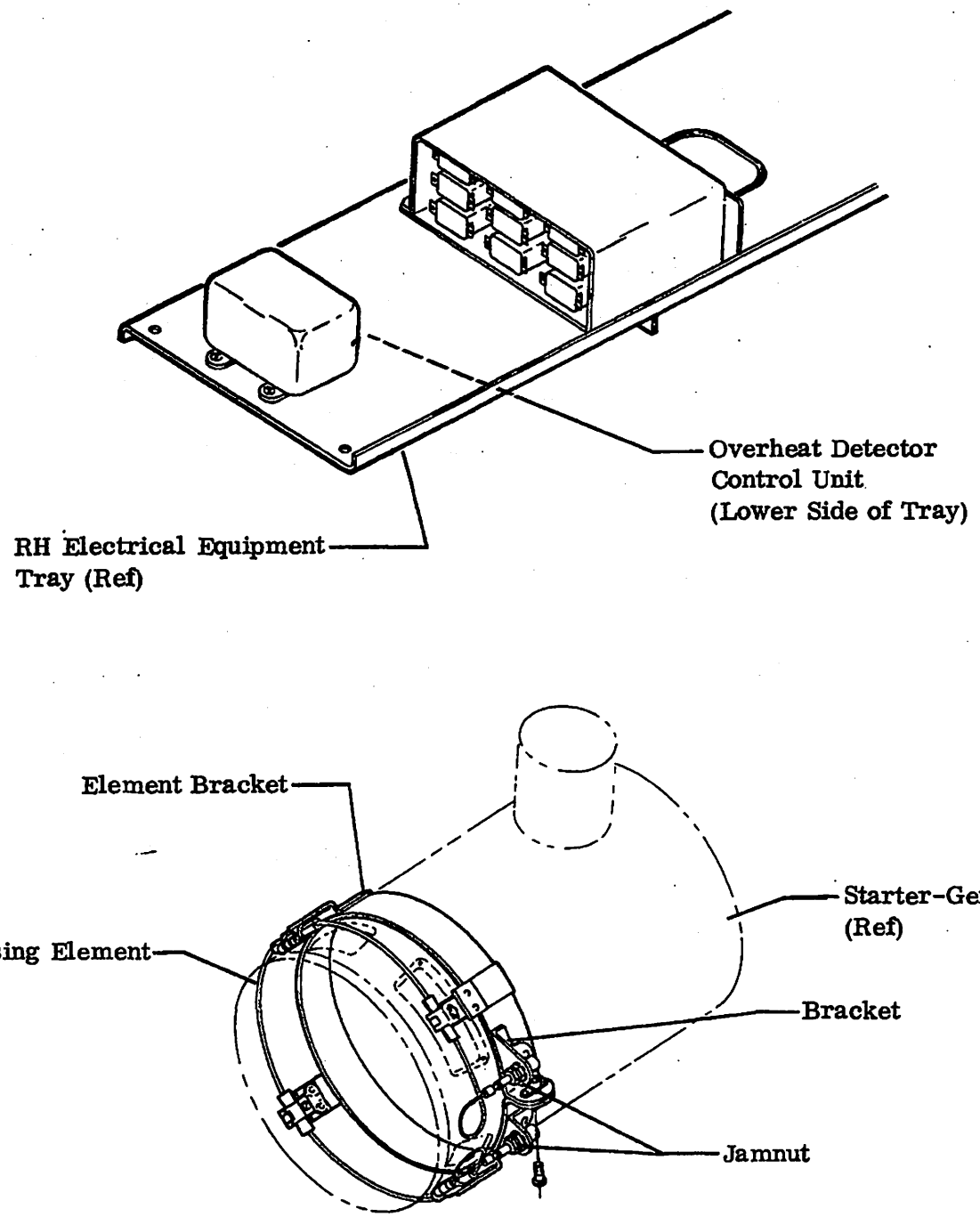
2. Removal/Installation
   A. Remove Detector Element (See figure 201)
      (1) Remove starter-generator. (Refer to 80-10-01)

      CAUTION: DO NOT ATTEMPT TO LOOSEN NUT ON AFT SIDE OF BRACKET. DAMAGE TO THE SENSING ELEMENT MAY OCCUR.

      (2) Loosen and remove jamnut from forward side of bracket. Remove remaining nut.
      (3) Release quick release fasteners and remove element from bracket.
   B. Install Detector Element (See figure 201)

      CAUTION: WHEN SECURING ELEMENT IN BRACKET ASSURE THAT ELEMENT AND GROMMET ARE CENTERED IN CLAMP.

      (1) Position element and grommet in clamp and secure.
      (2) Install nut and jamnut and secure. Assure that nut on aft side of bracket is used to hold element steady while tightening the nut and jamnut on the forward side.
      (3) Install starter-generator. (Refer to 80-10-01)
   C. Remove Control Unit (See figure 201)
      (1) Lower tailcone access door.
      (2) Disconnect both aircraft batteries.
      (3) Disconnect electrical plug from control unit.
      (4) Remove attaching parts and control unit from panel.
   D. Install Control Unit (See figure 201)
      (1) Install control unit and secure with attaching parts.
      (2) Connect electrical plug to unit.
      (3) Connect aircraft batteries.
      (4) Secure tailcone access door.




Overheat Detector System Installation
Figure 201